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| APPLICATION NO. | FILING DATE | FIRST NAMED INVENTOR | ATTORNEY DOCKET NO. | CONFIRMATION NO. |
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| 09/640,754      | 08/18/2000  | In Sung Kim          | SEC.747             | 7644             |

7590 11/18/2002  
Jones Volentile LLC  
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EXAMINER

LEE, HSIEN MING

|          |              |
|----------|--------------|
| ART UNIT | PAPER NUMBER |
|----------|--------------|

2823

DATE MAILED: 11/18/2002

Please find below and/or attached an Office communication concerning this application or proceeding.

**Office Action Summary**

Application No.

09/640,754

Applicant(s)

KIM ET AL.

Examiner

Hsien-Ming Lee

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --  
**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

- 1) ☒ Responsive to communication(s) filed on 02 July 2002.
- 2a) ☐ This action is **FINAL**.                      2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims**

- 4) ☒ Claim(s) 1-10, 14, 15 and 21-23 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☒ Claim(s) 9, 10, 14, 15 and 21-23 is/are allowed.
- 6) ☒ Claim(s) 1-8 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

**Application Papers**

- 9) ☒ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 18 August 2000 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on \_\_\_\_\_ is: a) ☐ approved b) ☐ disapproved by the Examiner.
- If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

**Priority under 35 U.S.C. §§ 119 and 120**

- 13) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All   b) ☐ Some \*   c) ☐ None of:
1. ☒ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- \* See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
- a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

**Attachment(s)**

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) \_\_\_\_\_.
- 4) ☐ Interview Summary (PTO-413) Paper No(s). \_\_\_\_\_.
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other:

### DETAILED ACTION

#### *Remarks*

1. The 102(e) rejection to claims 1-10,14-15 and 21-23 is withdrawn in response to applicant's argument filed 7/2/02.
2. Applicant's cancellation to claims 16-20 is acknowledged. Claims 1-10,14-15 and 21-23 are pending in the application.

#### *Specification*

- / 3. The disclosure is objected to because of the following informalities: a brief description for each individual figure is required. A broad description as stated on page 4 is not acceptable, i.e. at line 22, FIGS 3A to 9B are cross-sectional views .... ; and at line 25, FIGS. 10 through 16 are cross-sectional views..... Appropriate correction is required.

#### *Claim Rejections - 35 USC § 102*

4. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(a) the invention was known or used by others in this country, or patented or described in a printed publication in this or a foreign country, before the invention thereof by the applicant for a patent.

5. Claim 1-3 and 6-8 are rejected under 35 U.S.C. 102(a) as being anticipated by Teo (US 5,895,264).

With respect to claim 1, Teo in Figures 1-4 and related text teaches the claimed method of fabricating a semiconductor device, comprising:

- forming a conductive region 11 at the top of a semiconductor substrate 10 (Fig.1);

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- forming a first interlayer dielectric layer 12 on the semiconductor substrate 10 over the entirety of the conductive region 11 (Fig.1);
- forming a conductive line 13, which is to be connected to the conductive region 11, on the first interlayer dielectric layer 12 (Fig.1);
- forming a second interlayer dielectric layer 14/16 on the conductive line 13 (Fig.1);
- removing portions of the first interlayer dielectric layer 12, conductive line 13, and second interlayer dielectric layer 14/16 which overlie the conductive region 11 to form a contact hole 18 which exposes the conductive region 11 (Fig.3); and
- filling the contact hole 18 with a conductive material 19 to connect the conductive line 13 to the conductive region 11 (Fig.4).

With respect to claim 2, Teo also teaches said removing of portions of the first interlayer dielectric layer 12, conductive line 13, and second interlayer dielectric layer 14/16 comprising forming a patterned photosensitive film 17 on the second interlayer dielectric layer 14/16, the patterned photosensitive film 17 defining an opening<sup>18</sup> therein having a width that is greater than the critical dimension ( i.e. the thickness ) of the conductive line 13, etching the second interlayer dielectric layer 14/16 using the photosensitive film pattern 17 as an etch mask until the conductive line 13 is exposed, and etching the conductive line 13 and the first interlayer dielectric layer 12 using the etched second interlayer dielectric layer 14/16 as an etch mask (Figs. 2-3).

With respect to claim 3, Teo further teaches the etching of the conductive line 13 and the first interlayer dielectric layer 12 comprising etching the conductive line 13 using the etched

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second interlayer dielectric layer 14/16 as an etch mask to expose the first interlayer dielectric layer 12, and then discretely etching the exposed first interlayer dielectric layer 12 (Fig.3).

With respect to claims 6 and 7, Teo teaches removing the photosensitive film pattern before the conductive line 13 is etched (Fig.3).

With respect to claim 8, Teo teaches forming a dielectric film pattern defining a line-shaped opening 18 on the first interlayer dielectric layer 12, and depositing conductive material 19 in the line-shaped opening 18 (Figs.3-4).

***Claim Rejections - 35 USC § 103***

6. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

7. Claims 4 and 5 are rejected under 35 U.S.C. 103(a) as being unpatentable over Teo (US '264) in view of Kusumi et al. (US 6,228,755).

Teo substantially teaches the claimed method as stated above except a step of producing inclined sidewalls therein while anisotropically etching the second interlayer dielectric layer, whereby the cross-sectional area of an upper portion of the contact hole is greater than that of a lower portion thereof.

However, Kusumi et al., in an analogous art of anisotropically etching the interlayer dielectric layers 16 and 21 to form a contact hole 24/26 and filling the contact hole 24/26 with a conductive material layer 28 to connect a conductive region 12, disclose that the cross-sectional

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area of an upper portion of the contact hole 24/26 is greater than that of a lower portion thereof (Figs. 1D-1E).

Therefore, it would have been obvious to one of the ordinary skill in the art at the time of the invention was made to form the contact hole having the cross-sectional area of an upper portion of the contact hole being greater than that of a lower portion thereof as taught by Kusumi et al. in Teo's method of anisotropically etching the interlayer dielectric layers to form the contact hole. The motivation/suggestions for doing so would be to form a tapered contact hole, which is benefit to the filling of the conductive material in the contact hole and thus improve the reliability of a semiconductor device (col.7, lines 29-41, Kusumi et al.)

***Allowable Subject Matter***

8. Claims 9, 10, 14, 15 and 21-23 are allowed.
9. The following is a statement of reasons for the indication of allowable subject matter:

The closet prior art of record, Teo to US 5,895,264, teaches a method of fabricating semiconductor devices, comprising:

- forming a conductive region 11 at the top of a semiconductor substrate 10 (Fig.1);
- forming a first interlayer dielectric layer 12 on the semiconductor substrate 10 over the entirety of the conductive region 11 (Fi.g1);
- forming a conductive line 13, which is to be connected to the conductive region 11, on the first interlayer dielectric layer 12, the conductive line 13 having a gap therein of a predetermined width (Fig.1);

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- forming a second interlayer dielectric layer 14 on the conductive line 13 such that a first portion of the second interlayer dielectric layer 14 occupies the gap in the conductive line 13 (Fig.1);
- removing a portion of the first interlayer dielectric layer 12 overlying the conductive region 11, the first portion of the second interlayer dielectric layer 14 and a second portion of the second interlayer dielectric layer 14 to form a contact hole 18 (Fig.3); and
- filling the contact hole 18 with a conductive material 19 to connect the conductive line 13 to the conductive region 11 (Fig.4).

In contrast, Teo neither teaches nor suggests removing the first portion of the second interlayer dielectric layer 14/16 *occupying the gap in the conductive line 13* and a second portion of the second interlayer dielectric layer 14/16 *overlying the gap* to form the contact hole 18, wherein the contact hole 18 is for filling the conductive material 19, which would connect the conductive line 13 and the conductive region 11.

10. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Hsien-Ming Lee whose telephone number is 703-305-7341. The examiner can normally be reached on M-F (9:00 ~ 5:00).

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Olik Chaudhuri can be reached on 703-306-2794. The fax phone numbers for the organization where this application or proceeding is assigned are 703-305-0142 for regular communications and 703-305-0142 for After Final communications.

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Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is 703-308-0956.

A handwritten signature in black ink, appearing to read 'Hsien Ming Lee', with a stylized, flowing script.

Hsien Ming Lee  
November 13, 2002